May 15, 2003

Mr. Richard Karney, P.E.
Manager, ENERGY STAR Program
Building Technologies Program
U.S. Department of Energy
1000 Independence Avenue SW
Washington, DC 20585-0121

Dear Mr. Karney:

The Edison Electric Institute (EEI) is pleased to provide comments on the report entitled "ENERGY STAR (R) Labeling for Water Heaters" dated April 4, 2003, and the informal criteria discussion held on April 16, 2003.

EEI is the association of the United States investor-owned electric utilities, combination gas & electric utilities, industry affiliates, and associates worldwide. Its U.S. members serve 90 percent of all customers served by the investor-owned segment of the industry. They generate approximately 73 percent of all the electricity generated by electric utilities in the country and service 70 percent of all ultimate customers in the nation.

General Comments:

1) EEI would like to thank the U.S. Department of Energy (DOE) for allowing us to participate in the meeting. Traditionally, the Energy Star program and the labeling program has been solely a product of EPA, or DOE, or EPA and DOE, working alone or primarily with product manufacturers on a voluntary basis. Unfortunately, this process left out other stakeholders that could have provided valuable information, insights, and more parties to create a quicker "buy-in" of the program goals.

The process as outlined in the presentation shown on April 16, 2003, provides other stakeholders with several opportunities to provide input and guidance, which in our view, will help to make the Energy Star program better. Current legislation that is being considered by the U.S. Senate codifies Energy Star and may require such a process that DOE is undertaking with Energy Star labeling for water heaters. The proposed process could serve as a template or outline for future Energy Star product updates or introductions.

2) Based on the discussion at the April 16th meeting, as well as a review of the presentation and report, it appears that implementation Option 2 would be the option that would receive the most support. In this way, DOE could help to increase sales of higher efficiency equipment, maximize energy savings, while, at the same time, promote the "next generation" technologies that could be prove to be more market ready in a few years (such as gas condensing hot water heaters, gas storage water heaters with power venting, commercial oil storage water heaters "downsized" for the residential market, electric heat pump water heaters, and solar PV electric or flat plate thermal water heaters). Many of our specific comments will discuss technical problems with the current analysis. Once corrections are made to the analysis, EEI believes that the revisions will reinforce the fact that Option 2 is the best option for DOE.

3) Some parties at the meeting advocated not allowing high efficiency electric water heaters to be labeled as Energy Star units. This is not a good idea, as it will likely produce the result of many manufacturers refusing to participate, and many electric or combination electric/gas companies not promoting Energy Star water heaters. As a voluntary program, the goal should be to maximize energy savings and maximize private sector participation.

4) It makes sense to "kick off" the program on or slightly before January 20, 2004, when new efficiency standards for water heaters go into effect. It is likely that there will be many educational programs sponsored by retailers, state energy offices, utilities, and other groups that will notify the general public about the new standards. An Energy Star campaign that is timed for the new standards, and coordinated with other campaigns, may provide the most "bang for the buck" in terms of public awareness and purchasing decisions.

Specific Comments on the April 4, 2003 report:

1) In terms of energy usage baselines, DOE and its contractors should use values from the Residential Energy Consumption Survey (RECS), American Gas Association *Gas Facts*, utility end-use metering studies, Lawrence Berkeley National Laboratory Technical Support Documents and Life Cycle Cost Analysis for water heater energy efficiency standards, and other in situ analysis. Using DOE test procedures to show a baseline, and predict possible energy savings, significantly overstates both. The use of 64 gallons of hot water per day and a temperature setting of 135 F is significantly higher than most actual settings in U.S. residences.

The 2001 RECS should be out very soon, with updated data. From the 1997 RECS, the typical household in the US with an electric hot water heater uses 2,871 kWh per year - 40.3% less than the 4,807 kWh per year shown in the report. For natural gas storage water heaters, the 1997 RECS shows a typical usage of 24 thousand cubic feet. The heat content of natural gas is about 1020 Btu / cubic foot, which yields an annual usage of 24.5 mmBtu of gas per year, slightly less than the 25.3 mmBtu of gas per year shown in the report.

For oil storage water heaters, the 1997 RECs shows an annual usage of 221 gallons per year. Using a heat content of 150,000 Btu/gallon of fuel oil, 221 gallons is equivalent to 33.15 mmBtu per year, or 18.1% higher than the value of 28.4 mmBtu shown in the report.

More accurate energy usage baselines will lead to more accurate estimates of national energy savings.

2) Other factors will reduce hot water usage in the future. New clothes washer standards take effect in 2004 (Tier 1) and again in 2007 (Tier 2). According to the DOE publication "*Energy Savers: Tips on Saving Energy & Money at Home*," clothes washers typically account for 26% of a homeowner's hot water usage. In addition, more models of dishwashers (which account for 14% of hot water usage) are rated as Energy Star models, which will further reduce hot water usage in homes.

Therefore, projections of national energy savings should account for the increased efficiency of products that are major users of hot water in homes. In other words, the baseline energy usage of all water heaters has been declining, and will have an increase in the rate of decline after 2004 and 2007.

3) EEI is not sure why the baseline value for an electric storage water heater is shown to be 4,807 kWh per year and the baseline value for heat pump and solar water heaters is 4,857 kWh. Shouldn't the "baseline" values be the same (and lower, based on RECS and other end-use data)?

4) On page 14, there are some statements in the report that will only cause divisiveness and harm to the program. Such statements as "The energy and economic performance of a heat pump water heater versus a conventional gas storage-type water heater may not be significantly better." and "Burning a fuel (oil or gas) on site is one of the most efficient ways to heat water or condition space" and "Solar water heaters may not be cost effective compared to conventional gas storage technology either. Again, burning a fuel on site is economically attractive." and "Replacing conventional electric resistance storage tanks with solar water heaters may be a primary recommendation of ENERGY STAR water heater criteria." are easily challenged, and overall, make it appear that EPA and DOE would recommend oil and gas water heaters over solar and heat pump water heaters through the Energy Star program.

For the first statement about the energy and economic performance of a heat pump water heater, the report on page 16 shows the following energy usages for high-efficiency units:

Table 1: Annual Energy Performance of High Efficiency Water Heaters

Water heater type	Annual Energy Usage
Gas Storage	23,900,000 Btu / year
Oil Storage	27,200,000 Btu / year
Instant, Gas Fired	18,300,000 Btu / year
Heat Pump Water Heater	6,245,790 Btu / year (1,830 kWh / year)

Table 2: Annual Operating Cost of High Efficiency Water Heaters, based on the Draft Report and 2003 Prices (as shown in the April 9, 2003 edition of the *Federal Register*)

Water Heater Type	Annual Energy Usage	Unit Energy Cost	Annual Energy Cost
Gas Storage	23.9 mmBtu	$8.16 / mmBtu	$195.02
Oil Storage	27.2 mmBtu*	$8.80 / mmBtu (#2 oil)	$239.36
Instant, Gas Fired	18.3 mmBtu	$8.16 / mmBtu	$149.33
Heat Pump Water Heater	1,830 kWh*	$0.0841 / kWh	$153.90
Solar Water Heater	1,464 kWh*	$0.0841 / kWh	$123.12

*Note: EEI does not agree with these values, but is using them for illustrative purposes only.

Therefore, looking at annual operating costs only, and average energy rates, heat pump and solar water heaters are less expensive than gas or oil storage heaters.

Also, if economics are going to be a main criteria for the Energy Star label, then the logical step, based on economics, would be for solar water heaters not to have the Energy Star label, since the initial equipment and installation costs are so high (over $5,000 according to the draft report, compared to under $1,400 for all other technologies) that paybacks will be at least 25 years when compared to any other technology.

It should also be noted, in the retrofit market, it may be physically impossible or prohibitively expensive to replace a storage water heater with a heat pump or solar water heater. Units that are currently located in tight areas (closets, small utility rooms, under counters, etc) can not be considered candidates for other high-efficient technologies. For people in multi-family housing, with each dwelling having its own water heater (and no roof access), it is impossible to use solar technology as a retrofit.

EPA and DOE may want to perform a study on the market segments that can not be switched to other technologies. Promoting heat pump or solar water heaters to those segments would not be a good use of program funds.

5) In terms of the performance of solar water heaters, the report shows that out of a baseline usage of 4,857 kWh, the solar hot water heater will typically save 3,394 kWh per year (or 69.9% of the total). This implies that a typical solar water heater will have a solar fraction of 70%. From the equations on page 11 of the report, when considering an electric water heater with an Energy Factor of 0.9 as the auxiliary unit, the solar water heater would have to have a Solar Energy Factor of at least 3.0 to provide a solar fraction of 0.7, where the equation is:

Solar Fraction = 1 - (Energy Factor, auxiliary unit / Solar Energy Factor)

It should be noted that the vast majority of solar water heater systems have solar energy factors that are valued at 2.2 or less (based on the April 5, 2002 Directory of SRCC Certified Solar Water Heating System Ratings, with the web site of: http://www.solar-rating.org/ratings/og300directories/OG300DIRFULL_20020405.PDF).

A more realistic solar energy factor value, based on the SRCC Directory, is 2.0 (or less). In this case, the solar fraction, under ideal test conditions, is:

SF = 1 - (0.9 / 2.0) = 1 - 0.45 = 0.55

However, for estimating energy savings (and then extrapolating to national energy savings), the solar fraction should be modified for actual climate conditions. In terms of climate conditions, the National Oceanic and Atmospheric Administration (NOAA) provides excellent data on % of sunshine and cloudiness by city. As defined by NOAA, the average percentage of possible of sunshine is "the total time that sunshine reaches the surface of the earth is expressed as the percentage of the maximum amount possible from sunrise to sunset with clear sky conditions. "

The NOAA definition for cloudiness is as follows: "Cloudiness - Mean Number of Days - Clear (CL), Partly Cloudy (PC), Cloudy (CD) This table shows the mean number of days per category of cloudiness. The categories are determined for daylight hours only. Clear denotes zero to 3/10 average sky cover. Partly cloudy denotes 4/10 to 7/10 average sky cover. Cloudy denotes 8/10 to 10/10 average sky cover."

Table 3: NOAA data (through 2002) on Average Annual Sunshine and Cloudiness Conditions

City	Annual % Sunshine on Clear Days*	Number of Clear Days / Year**	Number of Cloudy Days / Year**
Birmingham, AL	57%	99	155
Anchorage, AK	41%	61	239
Phoenix, AZ	85%	211	70
Sacramento, CA	78%	188	100
Denver, CO	69%	115	120
Washington, DC	56%	96	164
Miami, FL	70%	74	115
Buffalo, NY	48%	54	208
Cleveland, OH	49%	66	202
Houston, TX	59%	90	161

*Sunshine data from NOAA

http://www.ncdc.noaa.gov/oa/climate/online/ccd/avgsun.html

**Cloudiness table

http://www.ncdc.noaa.gov/oa/climate/online/ccd/cldy.html

EEI would suggest that the solar fraction be modified based on actual values found in the SRCC directory, NOAA sunshine and cloudiness data, location (urban versus suburban versus rural) for general solar access (roof not blocked by other buildings, for example), and general topography (e.g., areas with more mountains and trees are likely to have less hours of sun for nearby homes).

In addition, EEI suggests that DOE and/or EPA obtain end-use data from utilities that monitor the performance of solar systems. For example, 11% of SMUD's customers have solar water heating systems and may have reported some on-site performance analysis. AEP has put solar panels on the roofs of schools, and monitored their performance. Information can be found at the following web site:

http://www.aep.com/environmental/renewables/solar/schoolProjects/default.htm

6) DOE should also calculate the impact of the transformation of commercial oil and gas water heaters into residential units, with energy factors in the range of 0.8 to 0.95, with market penetrations similar to that shown for heat pump water heaters. The report should mention that there are advanced technologies that exist for gas/oil water heaters, even though the savings may not be as large as with heat pump or solar water heaters. For example, what would be the impact of a market transformation program designed to encourage the retrofit of gas storage systems with gas instantaneous systems, or the use of instantaneous or commercial type gas water heaters (sized for residential applications) in new construction?

7) One of the statements in the report, on page 11, says "Because any solar water heater system will use less energy than a conventional storage system, any solar water heating system can be included as an ENERGY STAR qualified product."

EEI is concerned about this statement, and the philosophy it represents. It appears to say that any solar system, regardless of its performance, automatically receives the ENERGY STAR label. Other products that receive the ENERGY STAR label must meet certain performance criteria, and are not automatically given the label. DOE may want to develop a test procedure to test different solar systems and award the label to those systems that save the most energy. This will also prevent any "gaming" by vendors. If systems are installed that do not save energy, then the potential consumer backlash could hurt the Energy Star program.

8) A review of the DOE Residential Energy Consumption Survey on water heating will point out that electric water heaters, on average, have significantly less hot water usage than gas units. This is mostly due to rational economic decision making based on projected usage, not price response by identical customers. If the projected usage is high, a natural gas unit is more likely

to be chosen than an electric unit due to lower operating costs. Similarly, an extremely high hot water usage will be more likely to choose a heat pump water heater or solar one, based on the economics of that particular installation.

As stated earlier, using the DOE test procedure usage does not adequately reflect the water heater markets and usage in the United States. All customers are not "average" - some have much lower usage and some have much higher usage. For that reason as well, Energy Star products should be available for all market segments and all types of fuels. Allowing highly efficient electric resistance water heaters to qualify as Energy Star lets the low hot water usage market (or one where natural gas is not available) to have the choice of an Energy Star product. Otherwise, this market segment would be cut off from the Energy Star program, and would have no reasonable choices for buying energy efficient products.

Thank you for reviewing our comments, and allowing us to be a part of this process.

Sincerely,

Steve Rosenstock, P.E.
Manager, Energy Solutions
Edison Electric Institute

cc: Michael McGrath, EEI
Thomas Farkas, EEI